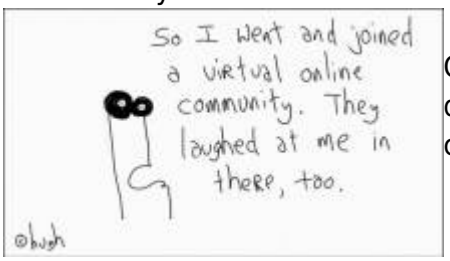
Community

Community Structure

In the three exercises in this section we will build a hypothetical community along an environmental gradient and then use the tools for classifying and sorting communities and seeing how they behave. The idea is to contrast two competing views of community ecology: (1) communities have defined boundaries and (2) there is a gradual transition in species replacement along environmental gradients.

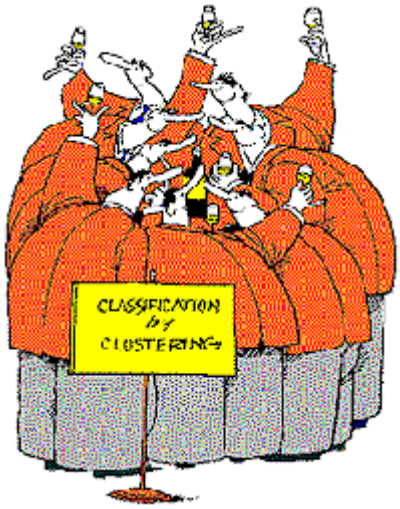
Virtual Community



Let's build virtual plant communities based on Frederic Clements' ideas of “superorganism” (communities with well-defined boundaries) and Henry Gleason's individualistic concept (communities without clearly defined boundaries).

- Virtual Community Tutorial

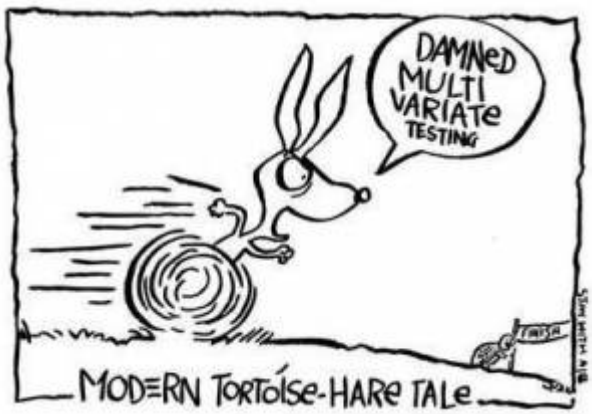
Classification



Classification methods group objects according to the similarity of their attributes. They serve to identify sets of more similar objects that, in our case, are plots of plants. However, the method can also be used for other noble purposes, such as classifying single malt scotch whiskey. This work was published in the journal Applied Statistics (1994) 43, No. 1, pp. 237-257, one of the most renowned journals in the field of Mathematics and Statistics, with one of the most renowned ecologists today, Pierre Legendre, from the University of Montreal in Canada. He and his son published one of the reference books for anyone interested in quantitative methods in ecology: “Numerical Ecology”. This exercise is dedicated to them.

- Classification by Clustering Tutorial

Ordenation



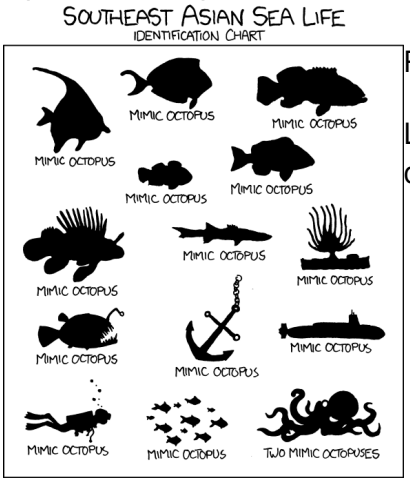
Ordination is a method of redescription of multivariate data in order to present them in few dimensions, usually 2 or 3, with minimal loss of information. Let's use one of the first ordination methods described - polar sorting. This method was developed by John Thomas Curtis and served as a way of revealing gradients in his studies of plant communities in Wisconsin, considered as evidence against Clements' theory of communities as a superorganism.

- Ordenation Tutorial

Succession and Disturbance

Natural disturbances were long considered an exogenous and rare factor in natural systems, but today they are fully incorporated as an important factor in the organization of communities. Furthermore, the study of disturbances acquired greater importance with the increase in their intensity and frequency by the action of man. After disturbances, plant communities tend to return to a state similar to the initial one, which we call ecological succession. Here we will address the relationships between disturbance and succession, focusing on coexistence and colonization/competition tradeoff in simple models of community dynamics.

Diversity and Stability



Are communities with more species more stable? In the 1970s Robert May showed that the opposite can happen.

Learn about the method used by May to assess the stability of dynamical systems and reproduce her results.

- Diversity and Stability Tutorial

Disturbance and Coexistence

- Disturbance and Coexistence Tutorial

Disturbance and Tradeoff

The concept of tradeoff is very important for ecology and evolution. In the ecological context, it is related, for example, to energetic constraints that prevent an individual from investing in several optimal strategies simultaneously, such as growing and reproducing. In the evolutionary context it is related to the selection of ecological strategies to the detriment of others that are also efficient, for example the size of fruits and the amount produced per reproductive event. Here we present the concept associated with different disturbance regimes.

- Tradeoff Tutorial

Ecological Succession

- Ecological Succession Tutorial

Regeneration Niche

- Regeneration Niche

Neutral Dynamics

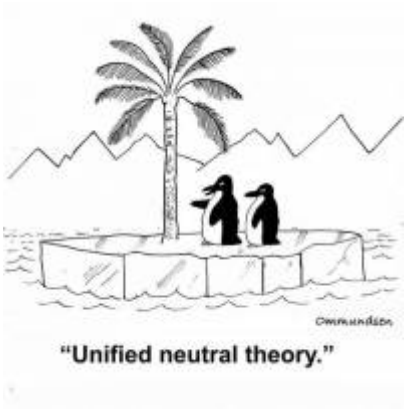
Neutral models in ecology assume that all species are competitively equivalent, unlike niche-based models. Let's examine two of the most important neutral theories in ecology, both published in Princenton University's influential monograph series MPB.

Island Biogeography

In addition to Motoo Kimura's 1968 neutral theory of molecular evolution, Hubbell drew heavily on MacArthur and Wilson's theory of island biogeography. The theory of island biogeography was created to explain a very recurrent pattern in nature: the relationship between the number of species in a place and its area. The most accepted theory so far, based on the idea that each species has a niche, proposed that larger islands had greater species richness because they contained greater habitat diversity. The theory of MacArthur and Wilson proposes that the number of species on an island is determined only by the rate of extinction of species already present on the island and the rate of immigration of species from the mainland.

- Biography of Islands Roadmap

Neutral Biodiversity Theory



Stephen Hubbell departed from the Theory of Island Biogeography and from his vast experience with tropical forest dynamics to propose a simple process of births and deaths that would explain the great diversity in the tropics. Learns about the controversial “Unified Neutral Theory of Biodiversity and Biogeography”, where species are equivalents.

- Script Neutral Theory of Biodiversity